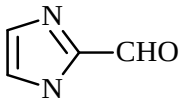
FINAL JEE–MAIN EXAMINATION – JANUARY, 2023
Held On Monday 30th January, 2023
TIME : 09:00 AM to 12:00 PM

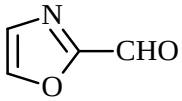
SECTION-A

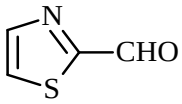
31. Which of the following compounds would give the following set of qualitative analysis ?

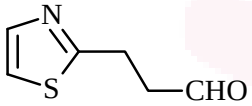
(i) Fehling's Test : Positive

(ii) Na fusion extract upon treatment with sodium nitroprusside gives a blood red colour but not

(1) 

(2) 

(3) 

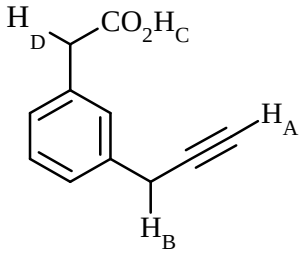
(4) 

Official Ans. by NTA (4)

Ans. (4)

Sol. Aromatic aldehydes do not give Fehling's test..
Both nitrogen and sulfur must be present to obtain blood red colour
Sodium nitroprusside gives blood red colour with S & N.

32. What is the correct order of acidity of the protons marked A–D in the given compounds ?



(1) $H_C > H_D > H_B > H_A$

(2) $H_C > H_D > H_A > H_B$

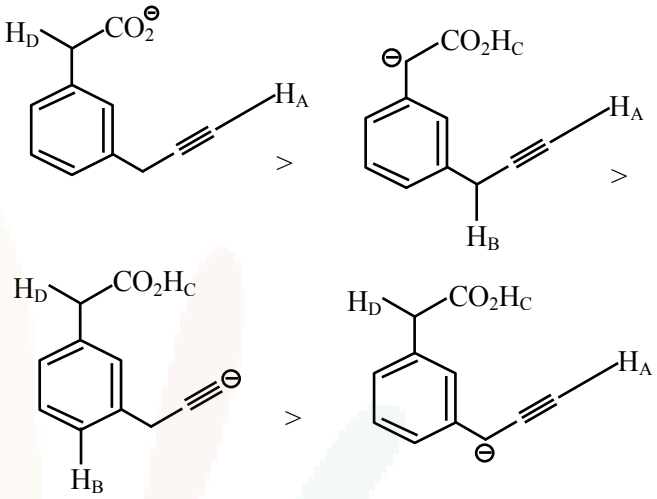
(3) $H_D > H_C > H_B > H_A$

(4) $H_C > H_A > H_D > H_B$

Official Ans. by NTA (2)

Ans. (2)

Sol. acidity of an acid depends upon the stability of its conjugate base



33. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : Ketoses give Seliwanoff's test faster than Aldoses.

Reason (R) : Ketoses undergo β-elimination followed by formation of furfural.

In the light of the above statements, choose the correct answer from the options given below :

(1) (A) is false but (R) is true

(2) Both (A) and (R) are true and (R) is the correct explanation of (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Official Ans. by NTA (3)

Ans. (3)

Sol. Seliwanoff 's test is a differentiating test for Ketose and aldose. This test relies on the principle that the keto hexose are more rapidly dehydrated to form 5-hydroxy methyl furfural when heated in acidic medium which on condensation with resorcinol, Cherry red or brown red coloured complex is formed rapidly indicating a positive test.

34. In the extraction of copper, its sulphide ore is heated in a reverberatory furnace after mixing with silica to :

(1) separate CuO as $CuSiO_3$

(2) remove calcium as $CaSiO_3$

(3) decrease the temperature needed for roasting of Cu_2S

(4) remove FeO as $FeSiO_3$

Official Ans. by NTA (4)

Ans. (4)

Sol. The copper ore contains iron, it is mixed with silica before heating in reverberatory furnace. FeO slags off as $FeSiO_3$.

$$FeO + SiO_2 \longrightarrow FeSiO_3$$

35. Amongst the following compounds, which one is an antacid ?

(1) Ranitidine (2) Meprobamate

(3) Terfenadine (4) Brompheniramine

Official Ans. by NTA (1)

Ans. (1)

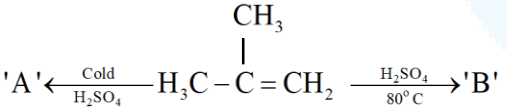
Sol. **1. Ranitidine:** Antacid

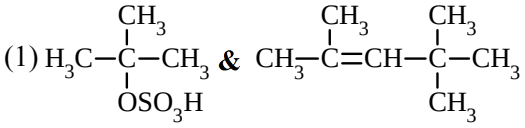
2. Meprobamate: Tranquilizer

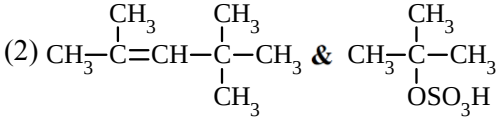
3. Terfenadine: Antihistamine

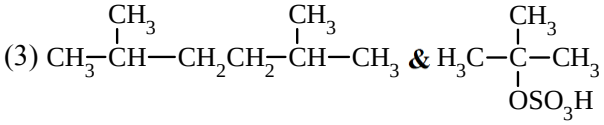
4. Brompheniramine: Antihistamine

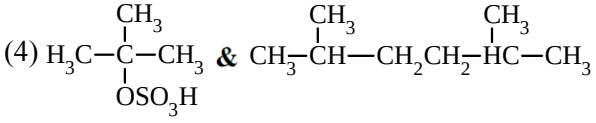
36. The major products 'A' and 'B', respectively, are



(1) 

(2) 

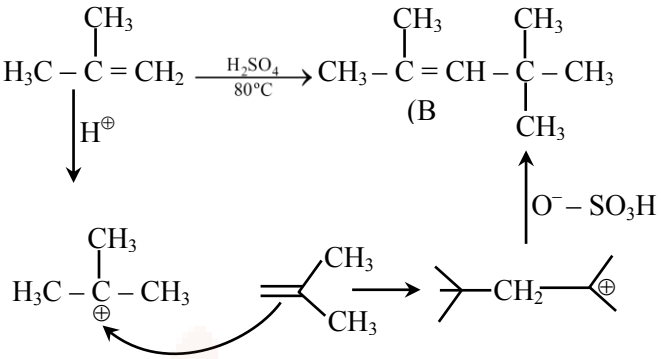
(3) 

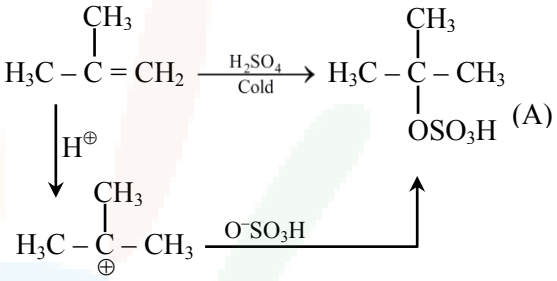
(4) 

Official Ans. by NTA (1)

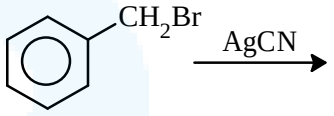
Ans. (1)

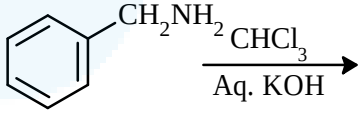
Sol.

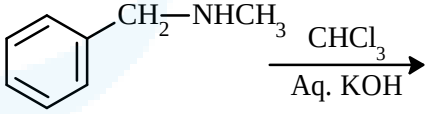


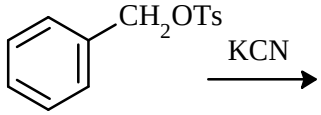


37. Benzyl isocyanide can be obtained by :

(A) 

(B) 

(C) 

(D) 

Choose the correct answer from the options given below :

(1) A and D

(2) Only B

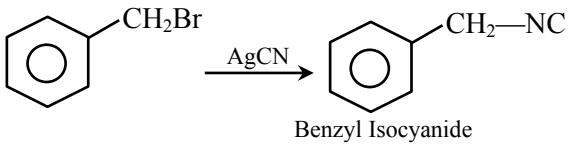
(3) A and B

(4) B and C

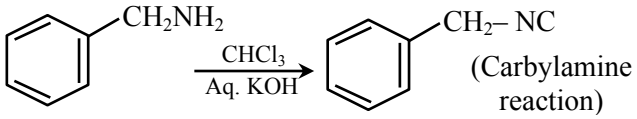
Official Ans. by NTA (3)

Ans. (3)

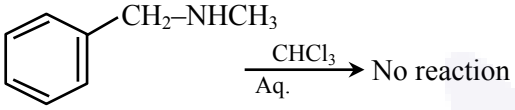
Sol.

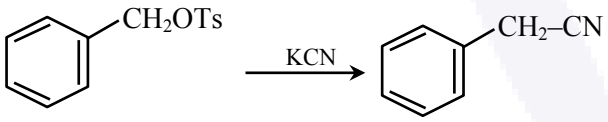


Benzyl Isocyanide



Benzyl Isocyanide





38. Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R).**

Assertion (A) : In expensive scientific instruments, silica gel is kept in watch-glasses or in semipermeable membrane bags.

Reason (R) : Silica gel adsorbs moisture from air via adsorption, thus protects the instrument from water corrosion (rusting) and / or prevents malfunctioning.

In the light of the above statements, choose the correct answer from the options given below :

(1) (A) is false but (R) is true

(2) (A) is true but (R) is false

(3) Both (A) and (R) are true and (R) is the correct explanation of (A)

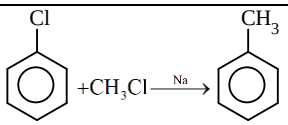
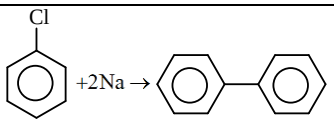
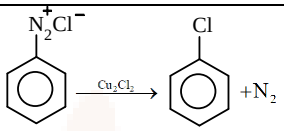
(4) Both (A) and (R) are true but (R) is not the correct explanation of (A)

Official Ans. by NTA (3)

Ans. (3)

Sol. Silica gel prevents water corrosion (rusting) and instrument malfunction by adsorbing moisture from the air.

39. Match **List I** with **List II**

List I		List II	
A		I	Fitting reaction
B		II	Wurtz Fitting reaction
C		III	Finkelstein reaction
D	$C_2H_5Cl + NaI \rightarrow C_2H_5I + NaCl$	IV	Sandmeyer reaction

(1) A – II, B – I, C – III, D – IV

(2) A – III, B – II, C – IV, D – I

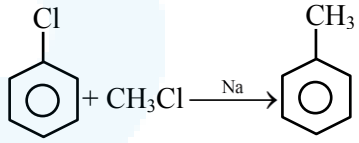
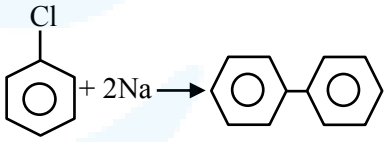
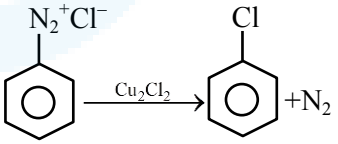
(3) A – IV, B – II, C – III, D – I

(4) A – II, B – I, C – IV, D – III

Official Ans. by NTA (4)

Ans. (4)

Sol.

LIST-I		LIST-II
A.		Wurtz-fitting reaction
B.		Fitting reaction
C.		Sandmeyer reaction
D.	$C_2H_5Cl + NaI \rightarrow C_2H_5I + NaCl$	Finkelstein reaction

40. Caprolactam when heated at high temperature in presence of water, gives

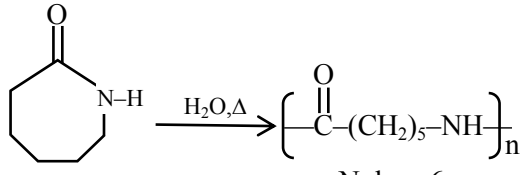
(1) Teflon (2) Dacron

(3) Nylon 6, 6 (4) Nylon 6

Official Ans. by NTA (4)

Ans. (4)

Sol.



Caprolactam Nylon -6

41. The alkaline earth metal sulphate(s) which are readily soluble in water is/are:

(A) $BeSO_4$

(B) $MgSO_4$

(C) $CaSO_4$

(D) $SrSO_4$

(E) $BaSO_4$

Choose the **correct** answer from the options given below:

(1) A only (2) B only

(3) A and B (4) B and C

Official Ans. by NTA (3)

Ans. (3)

Sol. Due to high hydration energy Be^{2+} and Mg^{2+}, $BeSO_4$ and $MgSO_4$ are readily soluble in water.

42. Which of the following is correct order of ligand field strength?

(1) $CO < en < NH_3 < C_2O_4^{2-} < S^{2-}$

(2) $S^{2-} < C_2O_4^{2-} < NH_3 < en < CO$

(3) $NH_3 < en < CO < S^{2-} < C_2O_4^{2-}$

(4) $S^{2-} < NH_3 < en < CO < C_2O_4^{2-}$

Official Ans. by NTA (2)

Ans. (2)

Sol. The increasing order of field strength of ligands (according to spectrochemical series)

$S^{2-} < C_2O_4^{2-} < NH_3 < en < CO$

43. Formation of photochemical smog involves the following reaction in which A, B and C are respectively.

(i) $NO_2 \xrightarrow{h\upsilon} A + B$

(ii) $B + O_2 \rightarrow C$

(iii) $A + C \rightarrow NO_2 + O_2$

Choose the correct answer from the options given below:

(1) $O, NO \& NO_3^-$ (2) $O, N_2O \& NO$

(3) $N, O_2 \& O_3$ (4) $NO, O \& O_3$

Official Ans. by NTA (4)

Ans. (4)

Sol. $NO_{2g} \xrightarrow{h\nu} \underset{(A)}{NO_g} + \underset{(B)}{O_g}$

$\underset{(B)}{O_g} + O_{2g} \rightleftharpoons \underset{(C)}{O_{3g}}$

$\underset{(A)}{NO_g} + \underset{(C)}{O_{3g}} \longrightarrow NO_{2g} + O_{2g}$

44. During the qualitative analysis of SO_3^{2-} using dilute H_2SO_4, SO_2 gas is evolved which turns $K_2Cr_2O_7$ solution (acidified with dilute H_2SO_4):

(1) Black (2) Red

(3) Green (4) Blue

Official Ans. by NTA (3)

Ans. (3)

Sol. $Cr_2O_7^{2-} + SO_3^{2-} \xrightarrow{H^+} \underset{\text{Green}}{Cr^{3+}} + SO_4^{2-}$

45. To inhibit the growth of tumours, identify the compounds used from the following:

(A) EDTA

(B) Coordination Compounds of Pt

(C) D – Penicillamine

(D) Cis – Platin

Choose the correct answer from the option given below:

(1) B and D Only

(2) C and D Only

(3) A and B Only

(4) A and C Only

Official Ans. by NTA (1)

Ans. (1)

Sol. Cis – Platin is used in chemotherapy to inhibits the growth of tumors. ($cis[Pt(NH_3)_2Cl_2]$)

46. In the wet tests for identification of various cations by precipitation, which transition element cation doesn't belong to group IV in qualitative inorganic analysis?

(1) Fe^{3+}

(2) Zn^{2+}

(3) Co^{2+}

(4) Ni^{2+}

Official Ans. by NTA (1)

Ans. (1)

Sol. $Zn^{2+}, Co^{2+}, Ni^{2+} = IV^{th}$ Group

$Fe^{3+} = III^{rd}$ Group

47. Match **List I** with **List II**

LIST–I (molecules/ions)		**LIST–II (No. of lone pairs of e^- on central atom)**	
(A)	IF_7	I.	Three
(B)	ICl_4^-	II.	One
(C)	XeF_6	III.	Two
(D)	XeF_2	IV.	Zero

Choose the **correct** answer from the options given below:
(1) A – II, B – III, C – IV, D – I
(2) A – IV, B – III, C – II, D – I
(3) A – II, B – I, C – IV, D – III
(4) A – IV, B – I, C – II, D – III
Official Ans. by NTA (2)

Ans. (2)

Sol. IF_7 zero lone pair

ICl_4^- two lone pair

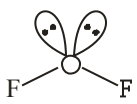
XeF_6 one lone pair

XeF_2 three lone pair

48. For OF_2 molecule consider the following:
(A) Number of lone pairs on oxygen is 2.
(B) FOF angle is less than 104.5^o .
(C) Oxidation state of O is –2.
(D) Molecule is bent 'V' shaped.
(E) Molecular geometry is linear.
Correct options are:
(1) C, D, E only
(2) B, E, A only
(3) A, C, D only
(4) A, B, D only
Official Ans. by NTA (4)

Ans. (4)

Sol.



- Two lone pair one oxygen
- Molecule is 'v' shaped
- Bond angle is less than 104.5°(102°)
- O·S· of 'O' is + 2

49. Lithium aluminium hydride can be prepared from the reaction of
(1) LiCl and Al_2H_6
(2) LiH and Al_2Cl_6
(3) LiCl, Al and H_2
(4) LiH and $Al(OH)_3$
Official Ans. by NTA (2)

Ans. (2)

Sol. $8LiH + Al_2Cl_6 \longrightarrow 2LiAlH_4 + 6LiCl$

50. Match **List – I** with **List – II**

LIST–I (Atomic number)		**LIST–II (Block of periodic table)**	
(A)	37	I.	p–block
(B)	78	II.	d–block
(C)	52	III.	f–block
(D)	65	IV.	s–block

Choose the **correct** answer from the options given below:
(1) A – II, B – IV, C – I, D – III
(2) A – I, B – III, C – IV, D – II
(3) A – IV, B – III, C – II, D – I
(4) A – IV, B – II, C – I, D – III
Official Ans. by NTA (4)

Ans. (4)

Sol.

Atomic number	**Block**
37 (K)	s-block
78 (Pt)	d-block
52 (Te)	p-block
65 (Tb)	f-block

SECTION-B

51. Consider the cell

$Pt_{(s)}\left|H_2(g,1atm)\right|H^+(aq,1M)\left|\right|Fe^{3+}(aq),Fe^{2+}(aq)\left|Pt(s)\right.$

When the potential of the cell is 0.712 V at 298 K, the ratio $\left[Fe^{2+}\right]/\left[Fe^{3+}\right]$ is _____.

(Nearest integer)

Given: $Fe^{3+}+e^-=Fe^{2+}, E^oFe^{3+},Fe^{2+}\left|Pt=0.771\right.$

$\frac{2.303RT}{F}=0.06V$

Official Ans. by NTA (10)

Ans. (10)

Sol

$Pt_{(s)}\left|H_2(g,1atm)\right|H^+(aq,1M)\left|\right|Fe^{3+}(aq),Fe^{2+}(aq)\left|Pt(s)\right.$

at anode $H_2 \longrightarrow 2H^+ + 2e^-$

At cathode $Fe^{3+}_{aq} + e^- \longrightarrow Fe^{2+}_{aq}$

$E^\circ = E^\circ_{H_2|H^+} + E^\circ_{Fe^{3+}|Fe^{2+}} = 0\cdot771V$

$E = E^\circ - \frac{0\cdot06}{1}\log\frac{Fe^{2+}}{Fe^{3+}}$

$0\cdot712 = (0+0\cdot771) - \frac{0\cdot06}{1}\log\frac{Fe^{2+}}{Fe^{3+}}$

$\log\frac{Fe^{2+}}{Fe^{3+}} = \frac{0\cdot059}{0\cdot06}\approx 1$

$\boxed{\frac{Fe^{2+}}{Fe^{3+}}=10}$

52. A 300 mL bottle of soft drink has 0.2 M CO_2 dissolved in it. Assuming CO_2 behaves as an ideal gas, the volume of the dissolved CO_2 at STP is _____ mL. (Nearest integer)

Given: At STP, molar volume of an ideal gas is $22.7\,L\,mol^{-1}$

Official Ans. by NTA (1362)

Ans. (1362 ml)

Sol. Mole of CO_2 = 0.2 M × (300 × 10^{-3}) L

= 0.06 Mole

Volume of 0.06 mole CO_2 at S.T.P

= 0.06 × 22.7

= 1.362 L

53. A solution containing 2 g of a non–volatile solute in 20 g of water boils at 373.52 K. The molecular mass of the solute is _____ $g\,mol^{-1}$. (Nearest integer)

Given, water boils at 373 K, K_b for water $= 0.52\,K\,kg\,mol^{-1}$

Official Ans. by NTA (100g)

Ans. (100g)

Sol. $\Delta T_b = 373.52 - 373$

$= 0.52$

$\Delta T_b = Kb\cdot m$

$0.52 = 0.52\times\frac{2}{\text{Molar Mass}}\times\frac{1}{20\times10^{-3}}$

Molar Mass = 100g/mol

54. If compound A reacts with B following first order kinetics with rate constant $2.011\times10^{-3}s^{-1}$. The time taken by A (in seconds) to reduce from 7 g to 2 g will be _____. (Nearest Integer)

$[\log5=0.698,\log7=0.845,\log2=0.301]$

Official Ans. by NTA (623)

Ans. (623)

Sol. $A + B \rightarrow P$

t = 0 7g

t = t 2g

at constant volume

$t = \frac{2.303}{K}\log\frac{[A]_0}{[A]_t}$

$= \frac{2\cdot303}{2\cdot011\times10^{-3}}\log\frac{7}{2}$

$= \frac{2\cdot303\times0\cdot544}{2\cdot011\times10^{-3}}$

$= 622.989$

≈ 623

55. The energy of one mole of photons of radiation of frequency 2×10^{12} Hz in $J\,mol^{-1}$ is _____. (Nearest integer)

(Given: $h = 6.626\times10^{-34}$ Js

$N_A = 6.022\times10^{23}\,mol^{-1}$)

Official Ans. by NTA (798)

Ans. (798)

Sol. For one photon E = hv

For one mole photon,

$E = 6\cdot023\times10^{23}\times6\cdot626\times10^{-34}\times2\times10^{12}$

$= 798\cdot16$ J

≈ 798 J

56. The number of electrons involved in the reduction of permanganate to manganese dioxide in acidic medium is _____.

Official Ans. by NTA (3)

Ans. (3)

Sol. $\overset{+7}{Mn}O_4^- + 4H^+ + 3e^- \longrightarrow \overset{+4}{Mn}O_2 + 2H_2O$

57. When 2 litre of ideal gas expands isothermally into vacuum to a total volume of 6 litre, the change in internal energy is _____ J. (Nearest integer)

Official Ans. by NTA (0)

Ans. (0)

Sol. For ideal gas U = f (T)

and for isothermal process, $\Delta U = 0$

58. 600 mL of 0.01M HCl is mixed with 400 mL of 0.01 M H_2SO_4. The pH of the mixture is _____ $\times10^{-2}$. (Nearest integer)

[Given $\log 2 = 0.30$, $\log 3 = 0.48$

$\log 5 = 0.69$ $\log 7 = 0.84$

$\log 11 = 1.04$]

Official Ans. by NTA (186)

Ans. (186)

Sol. Total milimoles of $H^+ = (600\times0.01) + (400\times0.01\times2)$

$= 1\,4$

$$\left[H^+\right] = \frac{14}{1000} = 14\times10^{-3}$$

$pH = 3 - \log 14$

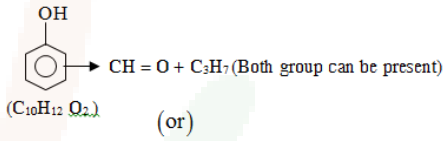
$= 1.86$

$= 186 \times 10^{-2}$

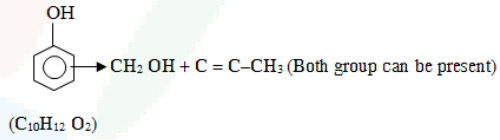
59. A trisubstituted compound 'A', $C_{10}H_{12}O_2$ gives neutral $FeCl_3$ test positive. Treatment of compound 'A' with NaOH and CH_3Br gives $C_{11}H_{14}O_2$, with hydroiodic acid gives methyl iodide and with hot conc. NaOH gives a compound B, $C_{10}H_{12}O_2$. Compound 'A' also decolorises alkaline $KMnO_4$. The number of π bond/s present in the compound 'A' is _____.

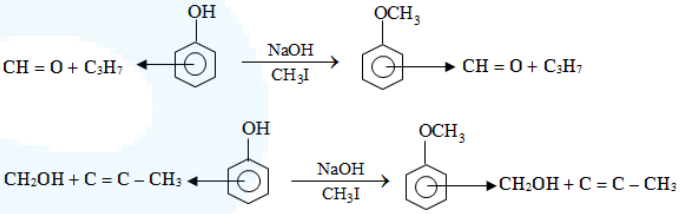
59 Official Ans. by NTA (4)

Ans. (4)



(or)





60. Some amount of dichloromethane (CH_2Cl_2) is added to 671.141 mL of chloroform $(CHCl_3)$ to prepare 2.6×10^{-3}M solution of CH_2Cl_2 (DCM). The concentration of DCM is _____ ppm (by mass).

Given: Atomic mass : C = 12; H : 1; Cl = 35.5

density of $CHCl_3 = 1.49\,g\,cm^{-3}$

Official Ans. by NTA (221)

Ans. (148)

Sol. $$\text{Molarity} = \frac{\text{mole}}{\text{volume}}$$

$$2.6\times10^{-3} = \frac{x/85}{0.67141}$$

$x = 0.148$ g

$$\text{conc. Fo DCM in ppm} = \frac{0.148}{1.49\times671.141}\times10^6$$

$= 148$ ppm